Date of Lab 3/19/10 Date of Submission 4/7/10

Physics Laboratory Report

Author Class 11-E Name Michihiro Matsugaki

Title Magnets and Clip Motor

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Summary

This lab experment was to understand the concept of magnetism, magnetic field and Tohei's right hand rule. Applying these terms into the lab was the main purpose. In the lab it may seem a very simple proces but in real life these factors are very vital. Many motors and generators al come from these terms above.

Teacher's Comment 重要なkeysをよくおさえてまとめている。

Toh

* レポートは、日本語あるいは英語で記載すること。
* この用紙をレポートの表紙として使うこと。
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Michihiro Matsugaki **Magnet Lab**

Introduction

Objective: Its purpose is to become comfortable with using mainly permanent magnets, compasses, and motors. Another objective is to understand the concept of the motion of an electric current, force, and magnetic field. Lastly, this experiment was mainly set up for to understand the forces between magnetic poles and able to map the magnetic fields.

Theory: In theory, magnetism is the ultimate source of any magnetic field, nothing more than the motion of an electric charge. In this world there are many kinds of magnet such as lodestone, ferrite magnet, aluminum nickel cobalt magnet, and Samarium cobalt magnet. In a magnet there are two poles, north pole and a south pole. Similar to charges, opposite poles repel and like poles attract. All the time the direction of the magnetic field is determined by the direction which the north pole of a compass points. In some cases when a current pass through the coil the "right hand nail" rule is used to determine the magnetic field. Also when magnets are added to the one above, the Tohei's right hand rule is used, which represents current- magnetic field-force.

Experimental:

Pictures on the 3rd + 4th pages

Apparatus: magnets, Magnetizer, coil, cables, polystyrene cup, compass, battery, a filter like paper, iron sand, paper clips, and a bucket of water.

Method:

1. At first place a rectangular magnet with north pole and south pole underneath a thin sheet of paper. Then gently, shake the cup with the iron sand and rain it over the paper. After you rain it over the paper, then place a compass near where the iron sands are scattered about. Check the direction which the north pole of a compass points around the iron sand and the magnet.

2. Next, you connect the two rectangular magnets and make it a long magnet. After this try to place paperclips at three points, which are the farthest sides and the middle where it is connected. Check to see what happens.

3. After, fill up a bowl with water, and place a small polystyrene plate on the surface of the water. Then place a rectangular metal on the plate, and grab a rectangular magnet. Once it is all set, hold the magnet and check what happens if the magnet becomes near.

4. For the forth experiment, one must get a magnet plate with aluminum surroundings. Then connect the jumper cables either positive or negative vice versa on either side of the end of the big rectangular plate. After the jumper cables are connected to the battery and the plate, place an aluminum rod on the aluminum surroundings. The aluminum surroundings should be a little higher than the magnet plate. This acts as a rail on the train tracks. Finally connect the batteries and see which way the aluminum rod moves.

5. Lastly, grab about 60cm of enameled wire, plastic cup, clips, magnet, scotch tape, jumper cable, 9 volt battery, and knife in order to create our personal clip motor. Next, wrap the wire about 8-10 times by a stick. While this process, place the paper clips on both sides of the bottom of the cup with scotch tape to place the enamel wire. After the paper clips, place the magnet on the plastic cup. Later, place the jumper cables that are connected to the batteries to the paper clips; and scrape off the red covering, enamel completely on one side and half on the other side. Finally, place the wire through the paper clips and check to see what happens.

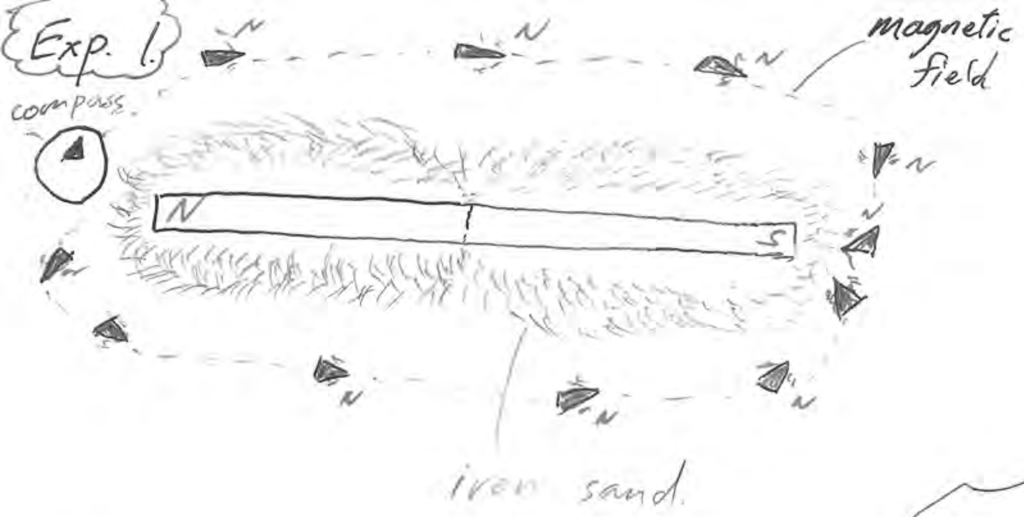
Result

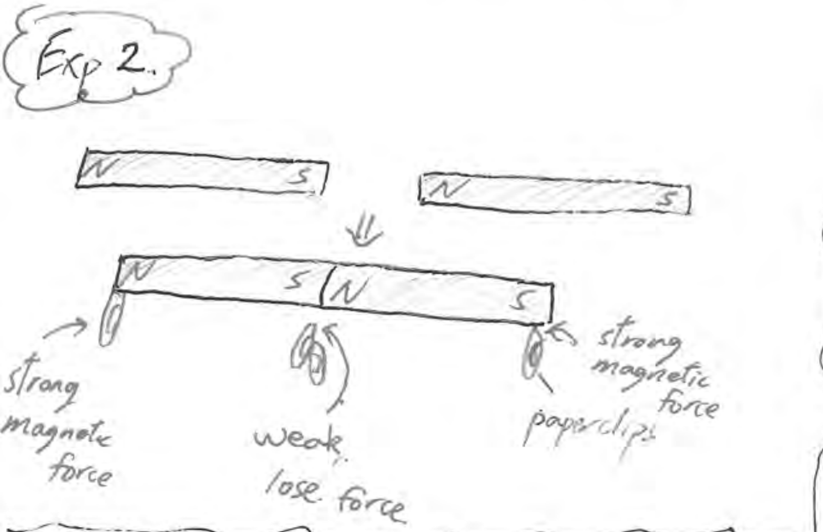
1. The scattered iron sand created like a circular pattern around the magnet underneath. When a compass was held the direction of the north pole of the compass took the exact same pass as the iron sand. The compass created a half circular path around the magnet, north pole coming out from one end and north pole of the compass coming into the south pole of the magnet.

   A magnetizer was used when the compass showed the total opposite of an expected pass. A magnetizer was used to strengthen and correct the magnet the way it is supposed to be, having the correct north pole and south pole.
2. The paper clips on both ends sticked to the magnet very strongly but the paper clip on the middle was weak and loose.
3. When south pole of the magnet was placed near the metal it attracted and start to move towards it but, when north pole of the magnet was placed near the metal it repelled and moved away.
4. At first with positive on the top end, the aluminum rod moved to the left and when the positive and the negative cables were switched the aluminum moved to the right.
5. The clip motor didn't spin at first but it spinned rapidly when the paperclips on both side were adjusted to the proper height and the jumper cables were connected to the battery.

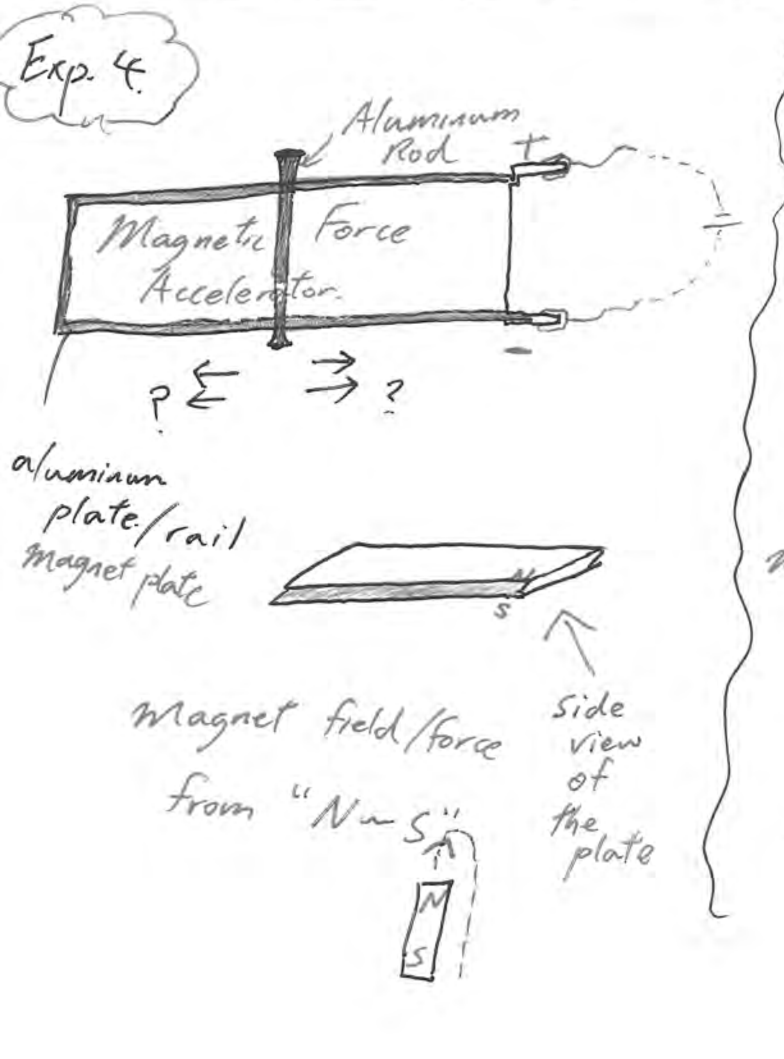
Discussion:

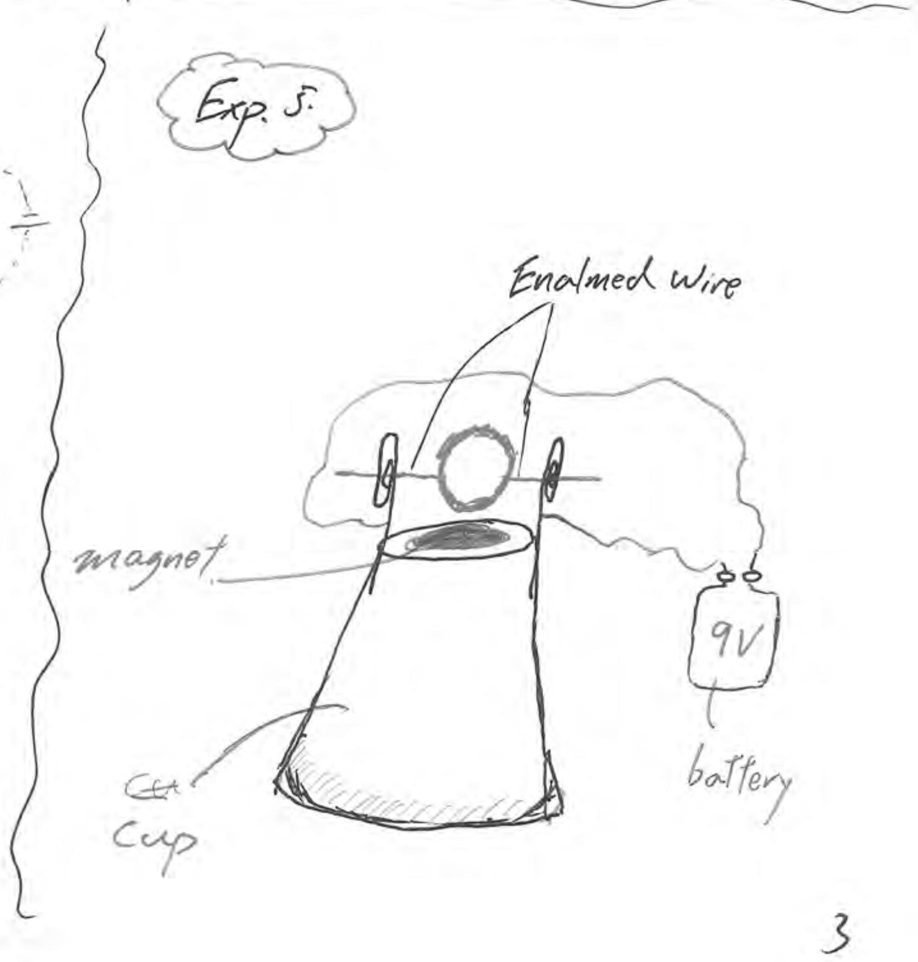
1. From this first experiment, it can be told that the direction of the magnetic field goes from the north pole to the south pole. The scattered iron represents the magnetic field around the magnet. The north pole of a compass shows the direction in which the magnetic field travels and since it took a circular path from one end of the magnet to the other end, which proves the actual magnetic field of a magnet. Good! One of the most important things
2. From the properties of magnet when the north end and the south end of the magnet are placed together, the magnet force becomes weaker. However the far two ends of the two magnets placed together have strong magnetic forces. This is the reason why the paperclips stick on the far ends and not really stick on the middle.
3. Also from the properties of magnet, like the attraction and repulsion of charges, opposite poles have a tendency to attract which made the magnet to come closer to the magnet.


Exp. 1.
magnetic field
compass
N
S
iron sand.


Exp 2.
N S
N S
N S N S
strong magnetic force
weak, lose force
strong magnetic force
paperclips

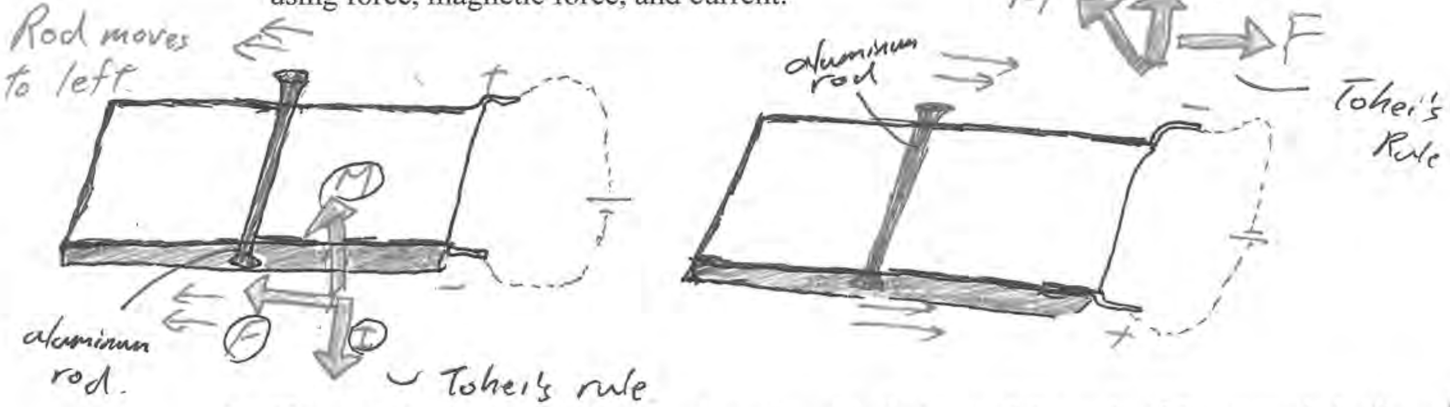

Exp. 3.
Magnets
N S


Exp. 4.
Aluminum Rod
+
-
Magnetic Force Accelerator.
? ?
aluminum plate/rail
magnet plate
N
S
side view of the plate
Magnet field/force from "N ~ S"
N
S


Exp. 5.
Enalmed wire
magnet
9V
battery
Cup

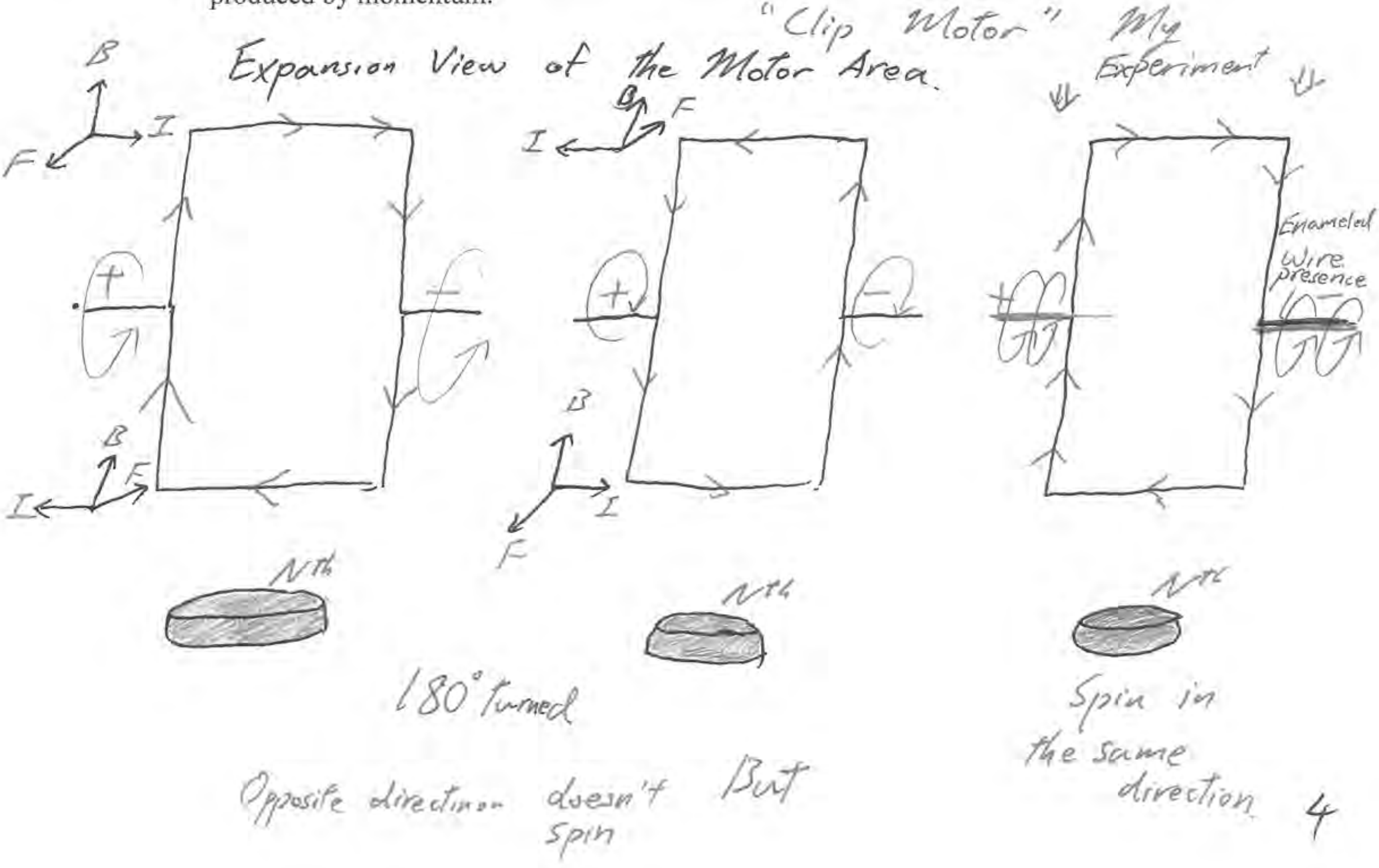
Like poles have a tendency to repel which made the magnet to turn the other direction and flow away.

4. From the Tohei's right hand rule the movement of the aluminum rod is very clear by using force, magnetic force, and current.



Good illustration

5. The simple reason of why the motor spinned is that one of the ends of the enameled wire was still present which caused the current unable to pass through the wire completely. Technically, when the motor spins 180 degrees the motor was supposed to spin the other way due to the Tohei's right hand rule. This would make the motor to a complete standstill, but like it mentions, thanks to the unscraped part of the ends of the enameled wire the current is not able to pass through, which would create the momentum ~~of~~ from spin~~ning~~ of the motor 180 degrees, to keep on moving on the same direction via energy produced by momentum.



Conclusion:

In conclusion, magnetism is a ultimate source of any magnetic field that is nothing more than the motion of electric charge. Magnets always have two poles. Opposite poles tend to attract and like poles like to repel. I have noticed that the direction which the north pole of a compass show is the direction of the magnetic field. In most cases it travels from the north pole to south pole in a circular way. In order to find the magnetic field the right hand rule is very convenient especially during checking out the magnetic field for coils, where the thumb or the four fingers represent either, current or magnetic field. The clip motors use the Tohei's right hand rule which determines the force of an object, where thumb is the current, index finger being the magnetic field, and the middle finger being the force.

Impression:

From this experiment, I was able to understand how Tohei's right hand rule can be applied to many things like the motor. Creating my own personal motor was very interesting, and I was able to further my understanding about the concept of motors. Understanding about magnetic field was very interesting, especially during the experiment of the iron sand. The circular pattern around the magnet seemed very decorative. I think the concept of magnetism and magnet is very important and used in many different fields like in generators. Therefore this experiment made it clear about magnetism by actually applying different kind of ideas (different kind of rules) to magnets/lab.

Date of Lab 3/19/10 Date of Submission 4/8/10

Physics Laboratory Report

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Title Lenz's Law

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Summary

This lab was done to understand the term Lenz's Law. This has been used in many different places in the world. All the generators come from this simple idea Lenz's Law. This is nothing that human beings can overlook because without this we wouldn't have electricity. This law continues to lighten up our planet earth.

Teacher's
Comment

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Michihiro Matsugaki
Physics Lab report
4/7/10
Dr. Moritani

Lenz's Law

Introduction:

Objective: This lab is to understand the idea of Lenz's rule. This term is used to create or produce electricity like generators.

Theory: Lenz's rule is mainly about how electricity is produce and the direction the current travels. It requires a galvanometer, coil, and a magnet to see how the current will be produced. This is the most possible simple generator that could be found in the world today. All the existing generators started from this.

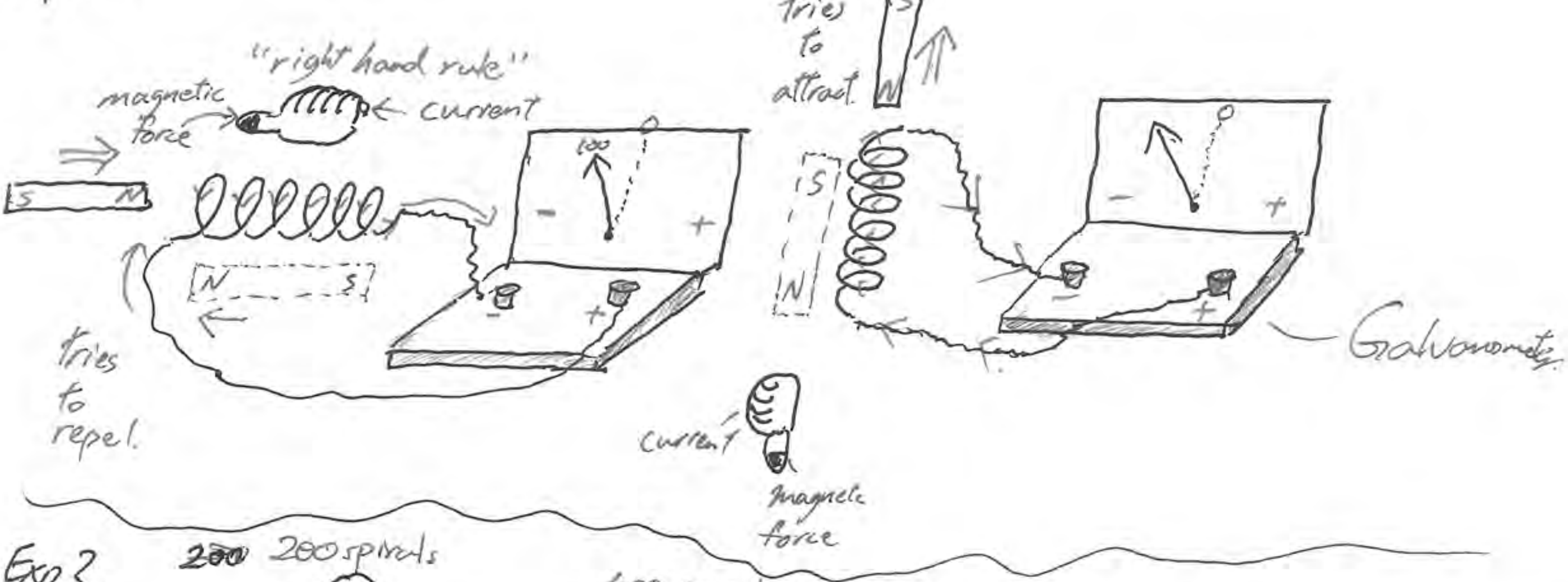
Experimental:

Apparatus: coil, galvanometer, magnet, some jumper cables.

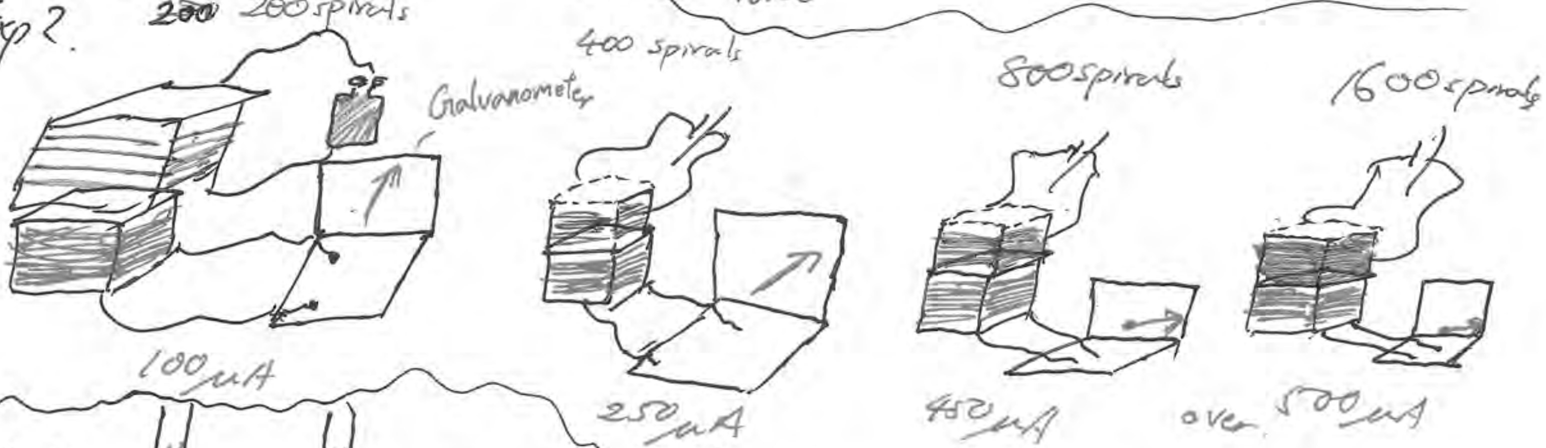
Method:

1. First roll a 20cm coil about 8 to 10 times, about the size so the middle finger can fit in. Then grab two jumper cables and attach it to the galvanometer, on each button, positive and negative. Then attach the other end onto the ends of the spiraled coil. After this is done get a magnet and place it near the coil from the top or the bottom. Check how the galvanometer shows up.
2. This experiment is about to see as the number of spiral increases what happens to the galvanometer. This was teacher demonstration. There were 4 trials.
3. This was the extension lab of experiment 1. This time make the spiral counterclockwise instead of clockwise. Then check to see what happens.
4. Last is, grab two magnets, galvanometer, split ring, cables, and the similar shaped coil to the clip motor. Place the coil between the two magnets, placed above and bottom. Then connect the cables with galvanometer, from the end of the coil to the either positive or negative. Same thing to the other side. A split ring should be placed right by the coil where the two ends of the coil are close to each other. Check what happens to the galvanometer.

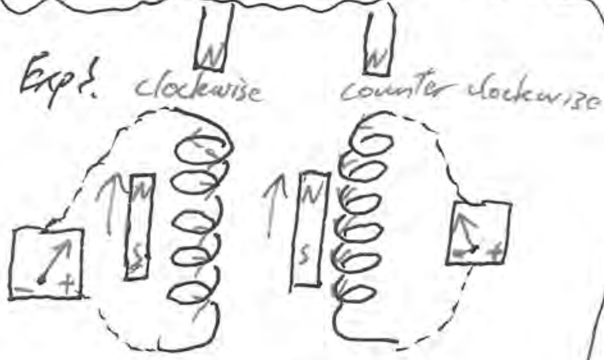
Exp. 1



Exp 2.

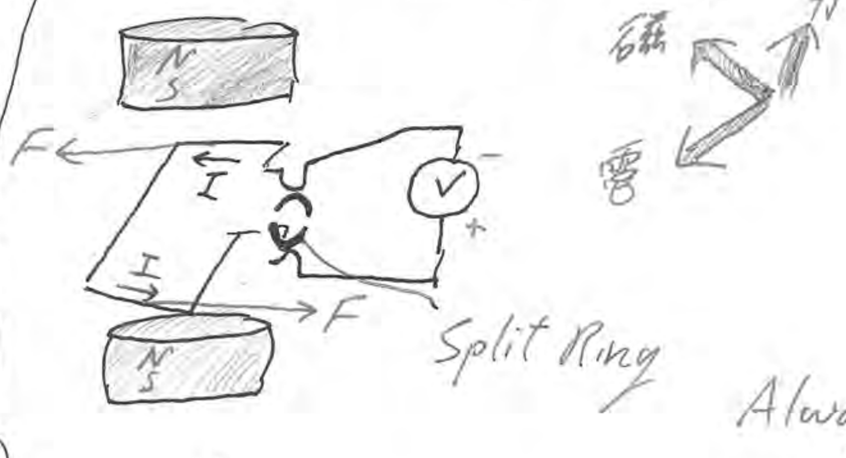


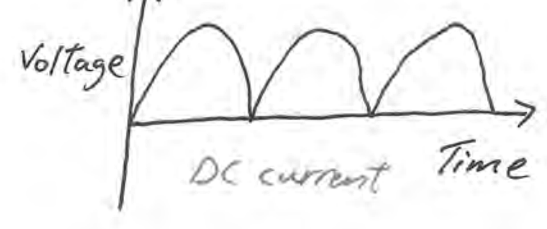
Exp 3.



Opposite Flow.

Exp 4. DC Generator





Always going current traveling in the same direction

Results:

1. First when we placed the North Pole near the coil, the galvanometer showed a positive current. When we moved the North Pole away slowly the galvanometer showed a negative current. When the South Pole was placed near the coil the similar thing happened.
2. For 200 spirals the galvanometer showed 100 μ A
   For 400 spirals it was 250 μ A
   For 800 spirals it was 450 μ A
   For 1600 spirals it was 500 μ A
3. For the clockwise spiral the galvanometer showed a positive current but for counter clockwise the current went the opposite way.
4. The coil spinned around and the galvanometer showed a positive current. The coil spinned in the same direction.

Discussion:

1. By Lenz's law, when the north pole of the magnet comes near the coil, the coil tries to repel the magnet by producing an imaginary north pole. This shows the direction of the magnetic field by using the right hand rule. The right hand is the magnetic field and the other fingers represent the current. By carefully tracing over the spirals with your fingers we are able to identify the movement and the direction of the current. In the case of the North Pole moves away from the coil, the coil tries to attract by producing an imaginary south pole. This would make the direction of the magnetic field down, and by using the right hand rule; you are able to find the current.
2. As the number of spirals increased the number of the galvanometer increased because more coil spirals mean more electricity being produced. That is why generators around the world are gigantic, in order to produce tons of electricity.
3. This is pretty much the same discussion as number one, but counters clockwise or clockwise makes only the direction of the current to travel.
4. Having a split Ring makes this a DC generator. The split ring makes the flow of the electricity to go in the same direction. This is a circular equipment between the wires of either sides. This will always make the graph look like the electricity flowing in and out from the same side.

Conclusion: In conclusion the Lenz's law is used in many places around the world. All the magnets placing near the coil to verify the direction of the current flow are used in like for charging objects. The coil acts the same way as a magnet. A good example of this daily used object is shaving device. Like during the experiment, the more spirals the more electric current flow. In the large range the generators use the lenz's law as well. For example hydrodynamic spins the turbine, and then the magnets spin near the coils. This becomes the lenz's rule which means as the magnets comes near and moves away the coil the electric flows in the opposite direction; vice versa. This makes it the AC generator. Therefore the generators use this method very often.

Impression: I think this lab was very interesting because this showed how generators work in real life. I believe from the Lenz law, people were able to create dams and others around the earth. This is the most basic concept, and many of the objects are extension of this term Lenz's law. I thought that it is not the electric bulb that was the most important invention but also the Lenz's law made it possible for electricity to travel across the globe. I thought that this was a huge step towards modernization in the 1920s.